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THE BIODIVERSITY OF CORALLINALES (RHODOPHYTA) IN SOUTHERN AUSTRALIA: 1976 VS 1996 WITH IMPLICATIONS FOR GENERATING A WORLD BIODIVERSITY DATABASE

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ABSTRACT — Our perception of the taxonomic biodiversity of coralline red algae (Corallinales, Rhodophyta) in southern Australia has undergone marked change between 1976 and 1996 as a consequence of rigorous monographic studies. Two subfamilies (Austrolithoideae, Choreonematoideae) and four genera unknown to science in 1976 (*Austrolithon*, *Lesueuria*, *Mastophoropsis*, *Synarthrophyton*) were described. Eleven genera reported to occur in 1976 have been removed from the flora but seven other genera were found to be present. Only 29.7% of the species and infraspecific taxa recorded in 1976 were confirmed to occur; the remaining 70.3% constituted spurious records or heterotypic synonyms of other taxa or were found to be of uncertain status. The total number of species present was reduced from 101 to 56, and 50% of those recorded in 1996 were not realised to be present in 1976. Within genera, the newly created 1976 database was 67-100% wrong in every genus with the exception of the monospecific *Choreonema*. The implications of these data for generating a reliable world biodiversity data base are discussed in relation to the critical role of taxonomy in the assessment and understanding of marine biodiversity, the decline in available taxonomic expertise and the use of various methods and approaches in determining and monitoring biodiversity at present.

RÉSUMÉ — Notre perception de la biodiversité taxinomique des corallines (Corallinales, Rhodophyta) en Australie du sud a subi de profonds changements entre 1976 et 1996, à la suite d'études monographiques rigoureuses. Deux sous-familles (Austrolithoideae, Choreonematoideae) et quatre genres (*Austrolithon*, *Lesueuria*, *Mastophoropsis*, *Synarthrophyton*), inconnus pour la science en 1976, ont été décrits. Onze genres ont été retirés de la flore pour des raisons nomenclaturales ou par suite de mentions erronées, mais onze autres genres ont été ajoutés (7 genres non encore répertoriés en Australie et 4 genres nouveaux pour la sciences). La présence des espèces et des taxons infraspecifics recensés en 1976 n'a été confirmée que pour seulement 29, 7% d'entre eux ; les 70,3% restant constituaient des mentions erronées, des synonymes hétérotypiques d'autres taxons ou bien des taxons dont le statut était apparu incertain. Le nombre total d'espèces présentes fût réduit de 101 à 56 et 50% de celles recensées en 1996 n'étaient pas connues en 1976. Au sein de chacun des genres, la base de données nouvellement créée en 1976 était fautive à 67-100%, à l'exception du genre monospécifique *Choreonema*. Les implications de ces données pour générer une base de données fiable sont discutées, au regard du rôle critique de la taxinomie dans l'établissement et la compréhension de la biodiversité marine, le déclin des possibilités d'expertise taxinomique et l'utilisation de méthodes et d'approches variées pour déterminer et surveiller l'établissement de la biodiversité.

INTRODUCTION

The marked change in our perception of the taxonomic biodiversity of coralline red algae (Corallinales, Rhodophyta) in southern Australia between 1976 and 1996 underscores the critical role of taxonomy in understanding marine biodiversity, as emphasised in the recent book by the Committee on Biological Diversity in Marine Systems (1995: 46-48, 60-61, 70). The purposes of the present paper are to document this change and then to consider certain implications for the world biodiversity database and various statements and conclusions of the CBDMS (Committee on Biological Diversity in Marine Systems) concerning the role of taxonomy in the assessment and understanding of marine biodiversity.

HISTORICAL BACKGROUND AND APPROACH

The 1976-1996 time frame has been chosen because 1976 marked the appearance of a review paper (Johansen, 1976) on generic concepts in coralline red algae and the onset of work by the present author on nongeniculate corallines in southern Australia, while 1996 marked the appearance of a book (Womersley, 1996) in which published and previously unpublished data on southern Australian Corallinales were consolidated in a floristic format.

The earliest published taxonomic records of southern Australian coralline red algae are those of Lamarck (1815) and Lamouroux (1816), which are based on collections gathered during French explorations between 1791 and 1804 (see Ducker, 1979a). Between 1815 and 1976, taxonomic data on southern Australian corallines appeared in a number of additional publications, including a floristic treatment (Lucas & Perrin, 1947) for South Australia and a partial census (May, 1965). Most data for the region, however, were fragmentary and scattered; no rigorous monographic accounts had appeared; and a critical review on the Corallinales of the sort published by Womersley (1956, 1967) for the Chlorophyta and Phaeophyta had not been produced.

Thus, in order to document properly the changes in our perception of the biodiversity of southern Australian Corallinales between 1976 and 1996, two databases have been newly constructed. The 1976 database (Appendix I) includes all taxa reported from southern Australia in literature published on or prior to 31 December 1976; the names used were considered current in 1976. Most of these data had existed previously in unpublished form on index cards compiled by Womersley and by Woelkerling. Generic placement of taxa reflects Johansen (1976) except as indicated in the Notes to Appendix I. Order, family and subfamily classification follows Johansen (1976: 232). The 1996 database (Appendix II) has been put together from information in monographic accounts and species studies of southern Australian taxa published after 1976, from information in Womersley (1996), and from further examination of type collections.

RESULTS

In 1976, all coralline red algae were placed in a single family (Corallinaceae) in the Order Cryptonemiales (Appendix I). Now (Appendix II) they are recognised as a distinct order of the Rhodophyta (see Silva & Johansen, 1986) containing two families: the Sporolithaceae, established by Verheij (1993), and the Corallinaceae. These changes were not based on southern Australian studies, although Townsend *et al.* (1995) clarified the distinctions between the two families as part of a study of *Sporolithon* in southern Australia.

Johansen (1976) recognised six subfamilies within the Corallinaceae; all are represented in the 1976 database. Subsequent work based mainly on southern Australian collections has led to the establishment of two additional subfamilies: the Choreonematoideae Woelkerling (1987a), for *Choreonema* (placed by Johansen, 1976, in the Mastophoroideae); and the Austrolithoideae A. Harvey & Woelkerling (1995), for *Austrolithon* and *Boreolithon*, newly described in the same paper. Neither the Choreonematoideae nor the Austrolithoideae are endemic to southern Australia. Within various subfamilies, tribes (see Lebednik, 1977: 381; Johansen, 1981: 187, 188; Woelkerling, 1988: 87) have been recognised by some authors. While Womersley & Johansen (1996a, 1996b) chose to recognise tribes within the Amphiroideae and Corallinoideae, Woelkerling (1988: 88) chose not to recognise tribes within the remaining subfamilies of Corallinaceae pending further studies of the relationships between genera and the stability of characters used for delimiting tribes. That view is reaffirmed here.

Southern Australian biodiversity changes at genus level

Less than half (14 of 36) of all genera of Corallinales recorded from southern Australia appear in both the 1976 and 1996 databases. These are *Amphiroa*, *Arthrocardia*, *Cheilosporum*, *Choreonema*, *Corallina*, *Haliptilon*, *Jania*, *Lithophyllum*, *Lithothamnion*, *Melobesia*, *Mesophyllum*, *Metagoniolithon*, *Metanastophora*, and *Neogoniolithon*. Eleven others (*Archaeolithothamnion*, *Chaetolithon*, *Cornicularia*, *Dermatolithon*, *Fostiella*, *Goniolithon*, *Heteroderma*, *Leptophyllum*, *Lichenella*, *Polyporolithon*, *Pseudolithophyllum*) present in the 1976 database have been removed from the 1996 database because they are now known to be heterotypic synonyms of other genera, are now considered to be of uncertain status, or are now known to be nomenclaturally illegitimate. The 1996 database also includes seven genera (*Hydrolithon*, *Lithoporella*, *Mastophora*, *Phymatolithon*, *Pneophyllum*, *Spongites*, *Sporolithon*) that were not recorded from the region in 1976 and four others (*Austrolithon*, *Lesueuria*, *Mastophoropsis*, *Synarthrophyton*) that were unknown to science in 1976. Thus, our perception of generic biodiversity of Corallinales in southern Australia has changed markedly as a consequence of rigorous post-1976 studies. While 25 genera occur in both the 1976 and 1996 databases, only 56% (14 of 25) are common to the two.

Southern Australian biodiversity changes below the level of genus

OVERALL NUMBER OF SPECIES AND INFRASPECIFIC TAXA. - A comparison of the 1976 and 1996 databases shows that, by 1976, a very inaccurate picture had built up in the literature at species level and below. Firstly, only 14 (13.9%) of the 101 species and infraspecific taxa

recorded in 1976 were verified to represent distinct taxa, to occur in southern Australia and to be placed correctly at generic level. Sixteen further taxa (15.8%) were verified to represent distinct taxa and occur in southern Australia, but were placed in the wrong genus. The remaining 71 taxa (70.3%) in the 1976 database were found to represent spurious records, constitute heterotypic synonyms of other taxa, or to be of uncertain status.

Secondly, specific and infraspecific biodiversity of Corallinales in southern Australia appears far lower than was indicated by pre-1977 literature records: 56 species and infraspecific taxa occur in the 1996 database while 101 occur in the 1976 database. Thus species and infraspecific biodiversity of southern Australian Corallinales had been overestimated by 80% (101/56).

Thirdly, southern Australian monographic studies during 1976-1996 led to the discovery of 12 species and infraspecific taxa unknown to science in 1976 and to the discovery of 14 specific and infraspecific taxa known to science in 1976 but unrecorded for southern Australia. Thus, 46% (26 of 56) of the species and infraspecific taxa now known to occur in southern Australia were not realised to be here in 1976.

CHANGES WITHIN PARTICULAR GENERA. — Data relating to changes within genera between 1976 and 1996 are summarised in Table 1. The only genus for which 1976 and 1996 data are identical is *Choreonema*, represented by the single species *C. thuretii*. Within *Arthrocardia*, *Halitilon*, *Lithophyllum* and *Neogoniolithon*, the 1976 database was totally inaccurate: none of the taxa present in the 1976 database were carried over into the 1996 database as distinct taxa within the same genus. In the nine other genera common to both databases, only 7-33% of the taxa present in the 1976 database were carried over into the 1996 database as distinct taxa within the same genus: carry-over figures for *Amphiroa* are 1 of 7; *Cheilosporum*, 1 of 5; *Corallina*, 1 of 14; *Jania*, 2 of 8; *Lithothamnion*, 2 of 12; *Melobesia*, 2 of 6; *Mesophyllum*, 2 of 10; *Metagoniolithon*, 1 of 4; *Metamastophora*, 1 of 4.

Direct comparisons of the remaining 22 genera between 1976 and 1996 are not possible as each occurred in one but not both databases. However, the picture provided by the 1976 database for all 22 can be interpreted as totally inaccurate since either the genus was removed between 1976 and 1996 or was not recorded until after 1976.

To summarise, post-1976 monographic and species studies have shown that the 1976 database, compiled from published literature, provided a grossly inaccurate picture of the taxonomic biodiversity of Corallinales in southern Australia both at genus level and at species and infraspecific levels. Of 25 genera known to be present in 1996, 1976 data were totally correct for only 1 (4%). Within the other 24 genera, the level of inaccuracy at specific and infraspecific levels ranged from 67-100%!

DISCUSSION

The Committee on Biological Diversity in Marine Systems (CBDMS) (1995: 1; see also World Conservation Monitoring Centre, 1992: xiii) defines biodiversity as 'the collection of genomes, species, and ecosystems occurring in a geographically defined region'. In this account, only species biodiversity, or more correctly taxonomic biodiversity, is being considered.

According to the CBDMS (1995: ix), recent widespread changes in marine biological diversity are largely due to effects of human activities, and marine ecologists

Table 1. Summary analysis of the 1976 and 1996 biodiversity data bases within recorded genera.

Genus	Species-intraspecific biodiversity		Number of 1976 taxa subsumed in other taxa	Number of 1976 taxa transferred as distinct taxa to other genera	Number of 1976 taxa removed from flora	Number of 1976 taxa verified to occur in 1996	Number of new and additional taxa in 1996
	1976	1996					
<i>Amphiroa</i>	7	2	4	0	2	1	1
<i>Archaeolithothamnion</i>	3	0	0	1	2	0	0
<i>Arthrocardia</i>	1	2	1	0	0	0	2
<i>Austrolithon</i>	undescr	1	-	-	-	-	1
<i>Chaetolithon</i>	1	subsum	1	0	0	-	-
<i>Cheilasporum</i>	5	1	2	2	0	1	0
<i>Choreonema</i>	1	1	0	0	0	1	0
<i>Corallina</i>	14	1	10	1	2	1	0
<i>Cornicularia</i>	5	illeg	3	1	1	0	11
<i>Dermatolithon</i>	1	subsum	0	1	0	-	-
<i>Fosliella</i>	1	subsum	0	1	0	-	-
<i>Goniolithon</i>	1	0	0	0	1	0	0
<i>Haliptilon</i>	1	1	0	0	1	0	1
<i>Heteroderma</i>	2	subsum	1	1	0	-	-
<i>Hydrolithon</i>	0	6	0	0	0	0	6
<i>Jania</i>	8	6	5	0	1	2	4
<i>Leptophytum</i>	2	subsum	1	1	0	-	-
<i>Lesueuria</i>	undescr	1	-	-	-	-	1
<i>Lichenella</i>	1	illeg	1	0	0	0	0
<i>Lithophyllum</i>	6	7	2	0	4	0	7
<i>Lithoporella</i>	0	1	0	0	0	0	1

Genus	Species-infraspecific biodiversity		Number of 1976 taxa subsumed in other taxa	Number of 1976 taxa transferred as distinct taxa to other genera	Number of 1976 taxa removed from flora	Number of 1976 taxa verified to occur in 1996	Number of new and additional taxa in 1996
	1976	1996					
<i>Lithothamnion</i>	12	2	7	1	2	2	0
<i>Mastophora</i>	0	1	0	0	0	0	1
<i>Mastophoropsis</i>	undescr	1	—	—	—	—	1
<i>Melobesia</i>	6	2	3	1	0	2	0
<i>Mesophyllum</i>	10	4	4	1	3	2	2
<i>Metagoniolithon</i>	4	3	2	1	0	1	2
<i>Metamastophora</i>	4	1	2	1	0	1	0
<i>Neogonolothon</i>	2	1	2	0	0	0	1
<i>Phymatolithon</i>	0	2	0	0	0	0	2
<i>Pneophyllum</i>	0	3	0	0	0	0	3
<i>Polyporolithon</i>	1	subsum	0	1	0	—	—
<i>Pseudolithophyllum</i>	2	subsum	1	1	0	—	—
<i>Spongites</i>	0	4	0	0	0	0	4
<i>Sporolithon</i>	0	1	0	0	0	0	1
<i>Synarthrophyton</i>	undescr	1	—	—	—	—	1
TOTALS	101	56	52	16	19	14	42

and oceanographers recognise their responsibility to document biodiversity changes and to understand their causes and consequences. In order to determine the nature and extent of taxonomic biodiversity changes, however, it is first necessary to have a *reliable* 'control' database against which changes can be measured. The present analysis of southern Australian Corallinales clearly has shown that taxonomic databases compiled only from existing literature records and/or in the absence of rigorous monographic studies are apt to be fraught with inaccuracies and provide misleading perceptions of the real biodiversity of a region. It is simply impossible to document taxonomic biodiversity changes accurately and to understand their causes and consequences in the absence of trustworthy baseline data. For the Corallinales, currently reliable databases based on monographic accounts and detailed species studies exist for only two regions worldwide: southern Australia (Womersley, 1996) and the British Isles (Irvine & Chamberlain, 1994). While neither of these databases can be considered final, both provide far more trustworthy baseline data than was hitherto available exclusively from literature compilation (compare Appendix I and Appendix II in this account, and data in Parke & Dixon, 1976 with data in Irvine & Chamberlain, 1994). Other regional studies of non-geniculate corallines (e.g. Dawson, 1960; Hamel & Lemoine, 1953; Masaki, 1968), if reassessed and updated by further rigorous studies, also could become reliable databases against which to measure change.

On a broader scale, there are very few areas for which currently reliable databases based on modern monographic accounts and detailed species studies could be generated. For most areas, as noted by the CBDMS (1995: 61), regional-scale databases for marine algal species do not exist in any form other than simple species lists. Indeed, most coastlines have been so scantily and haphazardly sampled and so few modern regional monographic accounts have been produced that any databases generated from species lists and similar records, or from floras based on such records, are apt to contain many inaccuracies and generate many false perceptions analogous to those now evident in the 1976 database for southern Australian Corallinales. The generation of regional-scale critical surveys and catalogues such as those of Athanasiadis (1996), Gonzalez-Gonzalez *et al.* (1996), Millar & Kraft (1993, 1994a, 1994b), Silva, Meñez & Moe (1987) and Silva, Basson & Moe (1996) are necessary preludes to more thorough monographic studies and detailed species studies. They are highly likely, however, to be unreliable if used as 'control' databases against which to measure biodiversity changes and would simply result in 'garbage-in, garbage-out' assessments.

The CBDMS (1995: 46, 70) has stressed that the ability to identify species is 'the key that permits the opening of the first door to an understanding of community structure and function' and that 'the importance of accurate and reliable taxonomy to studies of biodiversity cannot be overemphasised'. The change in our perception of taxonomic biodiversity of Corallinales in southern Australia clearly illustrates why reliable taxonomic studies are so essential.

The CBDMS (1995: 46, 47, 60) also has noted that:

- 1) the ability to identify species present is now being threatened by a continuing loss of scientists with the knowledge and ability to understand and describe biodiversity (see also Norton *et al.* 1996: 309);
- 2) traditional taxonomy and traditional taxonomists themselves have become "rare and endangered species";
- 3) in many cases there are no, or an inadequate number, of trained taxonomists in a geographic region to allow the documentation of the abundance and distribution of even well-known species;

- 4) training in taxonomy has declined dramatically over the last several decades; and
- 5) that in many systems, species diversity is so poorly known that the impact of human activities on diversity is difficult to assess at all.

Few would dispute these statements with respect to marine algal taxonomy. Thus, for example, of the 67.6 *paid* scientists (Richardson & McKenzie, 1992: 22) based at Australian herbaria and engaged in botanical taxonomic research in 1991, only 1.5 were involved in algal taxonomy and only 1.0 dealt with marine algae. The algal situation at Australian herbaria is unchanged in 1996.

To address this situation, the CBDMS (1995: 3, 23) has developed a research agenda on marine biodiversity with five fundamental objectives, one of which is 'to strengthen and expand the field of marine taxonomy through training, the development of new methodologies, and enhanced information dissemination, and to raise the standard of taxonomic competence in all marine ecological research'. This agenda, according to the CBDMS (1995: 3) 'would require significant advances in taxonomic expertise for identifying marine organisms and documenting their distributions, in knowledge of local and regional patterns of biodiversity, and in understanding of the processes that create and maintain these patterns in space and time'.

The CBDMS (1995: 11) also has suggested that 'although the number of undescribed, underdescribed, and inaccurately described species in the oceans appears daunting, new techniques and approaches are rapidly improving the ability to detect and describe the genetic, species and ecosystem diversity of the oceans'. The CBDMS (1995: 75) also specifically targeted the use of molecular techniques as part of the marine biodiversity initiative, stating that one thing the initiative would do is 'stimulate the field of marine taxonomy and systematics, particularly the incorporation of molecular techniques for species identification and population differentiation'. Similarly, Norton *et al.* (1996: 309) state: 'Molecular techniques have hardly begun to demonstrate their usefulness, but few doubt that they soon will be an indispensable tool for the algal taxonomist and will revolutionise algal systematics just as the electron microscope has done'.

The development of new methodologies, new techniques and approaches, and the incorporation of molecular techniques for species identification will NOT in and of themselves result in the production of increasingly reliable taxonomic biodiversity databases. The real 'key' to the production of increasingly reliable taxonomic biodiversity databases is high-quality, scientifically rigorous taxonomic research involving detailed studies of species, and the publication of regional-scale (see CBDMS, 1995: 20-22) and world monographic accounts using both proven, long established methodologies, techniques and approaches [e.g see Davis & Heywood (1963) and the essays of van Steenis (1957) and Silva (1984)] as well as recently developed ones appropriate to the situation. The post-1976 monographic work and species studies on southern Australian Corallinales did not involve the incorporation of molecular techniques or numerical taxonomy (the similarly heralded methodology of the 1960's; see Sokal & Sneath, 1963) for species identification. Yet it resulted in a much improved understanding of coralline biodiversity in the region. Indeed, the use of molecular techniques for species identification in southern Australia would have been highly inappropriate during the 1976-1996 period since species concepts had yet to be clarified on a morphological-anatomical basis. Now that this has been done, molecular techniques MAY be appropriate for testing hypotheses on species concepts that have emerged from morphological-anatomical studies, or in helping to determine the status and disposition of taxa for which morphological-anatomical uncertainties still exist, or in helping to determine phylogenetic relationships.

Molecular techniques (and numerical taxonomic techniques) have their place in marine algal systematics, but should not be singled out in relation to other techniques, approaches and methodologies, either new or time-tested and proven. The problems of taxonomy are complex ones requiring a range of appropriate methodologies, techniques and approaches for reliable resolution; no single tool, such as molecular techniques or numerical taxonomy, will work in isolation, and no combination of methodologies, techniques and approaches will work either unless appropriately and rigorously applied.

Finally, the CBDMS (1995: 47) has noted that 'taxonomic competence is just as important for ecology as are rigorous statistics', that few ecologists have had any formal training in taxonomic methods or principles, that many ecological studies have been compromised by taxonomic mistakes, and that 'there are currently no rewards or penalties for good or bad taxonomic work on the part of ecologists and biological oceanographers, nor clear mechanisms by which to assess the quality of such work'. There also seem to be no current rewards or penalties for good or bad taxonomic work on the part of those considering themselves taxonomists, and quality assessment mechanisms certainly could be improved. The marine algal taxonomic literature is still cluttered with publications of little or no scientific rigour or significance that are unhelpful in resolving problems of algal taxonomy and biodiversity and do little other than to besmirch a scientific discipline of importance in its own right and essential to the development of knowledge in related disciplines. If significant progress is to be made in our understanding of regional-scale and global algal biodiversity, concerted efforts are now needed to produce regional-scale summaries of current information and to produce detailed studies of species and regional-scale or world monographs of high standard and scientific rigour. This can only be accomplished with appropriate financial support and by ensuring that there are a sufficient number of competent taxonomists who know and understand taxonomic procedures and principles and apply them in a scientifically rigorous manner to their research.

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**APPENDIX 1: BIODIVERSITY OF CORALLINALES (RHODOPHYTA)
IN SOUTHERN AUSTRALIA BASED ON DATA PUBLISHED
UP TO THE END OF DECEMBER 1976**

The following inventory includes all specific and infraspecific taxa recorded from southern Australia in 1976. Names used are those current in 1976 or reflect those used in Adey (1970). Generic placement reflects Johansen (1976: 232) except where appropriate combinations had not been made. Order, family and subfamily classification follows Johansen (1976: 232). Footnotes to certain taxa, indicated by superscripts in the text, appear at the end (pp. 256-257).

Order Cryptonemiales

Family Corallinaceae

Subfamily Amphiroidea

Genus *Amphiroa*

A. unceps (Lamarck) Decaisne 1842b: 125.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: May 1965: 357; Chapman & Parkinson 1974: 172. Additional records provided by Womersley & Johansen 1996a: 285.

STATUS IN 1996: recognised as a distinct species of *Amphiroa*; see Appendix 2.

TAXA BASED ON SOUTHERN AUSTRALIAN TYPES THAT WERE CONSIDERED SYNONYMS IN 1976: *A. dilatata* Lamouroux, *A. galaxauroides* Sonder and *A. nobilis* Kützing (according to Yendo 1905: 5 and Weber-van Bosse 1904: 93).

A. beauvoisii Lamouroux 1816: 299.

SOUTHERN AUSTRALIAN RECORD PRIOR TO 1976: King *et al.* 1971: 121.

STATUS IN 1996: Spurious record based on misidentification; see Womersley & Johansen 1996a: 285, 286.

A. ephedraea (Lamarck) Decaisne 1842b: 112.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 394; May 1965: 357. Additional records provided by Womersley & Johansen 1996a: 285.

STATUS IN 1996: Spurious record based on misidentification; see Womersley & Johansen 1996a: 285, 286.

A. stelligera var. *densa* Kützing 1858: 26.

SOUTHERN AUSTRALIAN RECORD PRIOR TO 1976: Kützing 1858: 26, pl. 52, figs a, c-g. See Ducker 1979b: 83 and Womersley & Johansen 1996c: 320.

STATUS IN 1996: Heterotypic synonym of *Metagoniolithon stelliferum* var. *stelliferum*; see Ducker 1979b: 83 and Womersley & Johansen 1996c: 320.

A. stelligera var. *interrupta* Kützing 1858: 26.

SOUTHERN AUSTRALIAN RECORD PRIOR TO 1976: Kützing 1858: 26, pl. 52, fig. h. See Ducker 1979b: 83 and Womersley & Johansen 1996c: 320.

STATUS IN 1996: Heterotypic synonym of *Metagoniolithon stelliferum* var. *stelliferum*; see Ducker 1979b: 83 and Womersley & Johansen 1996c: 320.

A. stelligera var. *laxa* Kützing 1858: 26.

SOUTHERN AUSTRALIAN RECORD PRIOR TO 1976: Kützing 1858: 26, pl. 53, fig. b. See Ducker 1979b: 83 and Womersley & Johansen 1996c: 320.

STATUS IN 1996: Heterotypic synonym of *Metagoniolithon stelliferum* var. *stelliferum*; see Ducker 1979b: 83 and Womersley & Johansen 1996c: 320.

A. stelligera var. *nuda* Kützing 1858: 26.

SOUTHERN AUSTRALIAN RECORD PRIOR TO 1976: Kützing 1858: 26, pl. 53, figs c, d. See Ducker 1979b: 83 and Womersley & Johansen 1996c: 320.

STATUS IN 1996: Heterotypic synonym of *Metagoniolithon stelliferum* var. *stelliferum*; see Ducker 1979b: 83 and Womersley & Johansen 1996c: 320.

Subfamily Corallinoideae

Genus *Arthrocardia*

A. corymbosa (Lamouroux) Decaisne 1842a: 365.

SOUTHERN AUSTRALIAN RECORD PRIOR TO 1976: Chapman & Parkinson 1974: 175.

STATUS IN 1996: Unconfirmed record; not explicitly mentioned in Womersley & Johansen 1988 or Womersley & Johansen 1996b, but probably included by them in *Arthrocardia wardii* because Harvey 1849: 99 is cited both in Chapman & Parkinson 1974: 175 and Womersley & Johansen 1996b: 293.

NOTE: *A. corymbosa* is the lectotype species of *Arthrocardia*.

Genus *Cheilosporum*

C. elegans (Hooker & W.H. Harvey) Areschoug 1852: 546.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Womersley 1966: 146; Chapman & Parkinson 1974: 173, pis 55A, 57B. Additional records provided by Womersley & Johansen 1996b: 315.

STATUS IN 1996: Heterotypic synonym of *C. sagittatum*; see Womersley & Johansen 1996b: 315.

C. mallardiae (W.H. Harvey) De Toni 1905: 1828.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 397; May 1965: 356. Additional records provided by Womersley & Johansen 1996b: 293.

STATUS IN 1996: Heterotypic synonym of *Arthrocardia wardii*; see Womersley & Johansen 1996b: 293.

C. pulchellum W.H. Harvey 1855: 547.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 397; May 1965: 356. Additional records provided by Womersley & Johansen 1996b: 309.

STATUS IN 1996: recognised as a distinct species of *Jania*; see Appendix 2.

C. sagittatum (Lamouroux) Areschoug 1852: 545.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 396, fig. 200; May 1965: 356. Additional records provided by Womersley & Johansen 1996b: 315.

STATUS IN 1996: Recognised as a distinct species of *Cheilosporum*; see Appendix 2.

C. wardii (W.H. Harvey) De Toni 1905: 1828.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 397; Guiler 1952: 87 (as *Arthrocardia*); May 1965: 356; Chapman & Parkinson 1974: 174. Additional records provided by Womersley & Johansen 1996b: 293.

STATUS IN 1996: Recognised as a distinct species of *Arthrocardia*; see Womersley & Johansen 1988: 40; 1996b: 293.

Genus *Corallina*

C. calliptera Kützing 1849: 705.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Sonder 1880: 21; De Toni 1905: 1853. Additional records provided by Womersley & Johansen 1996b: 311.

STATUS IN 1996: Heterotypic synonym of *Halitilon roseum*; see Womersley & Johansen 1996b: 311.

C. chilensis Decaisne in W.H. Harvey 1849: 103.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: W.H. Harvey 1863: xxviii; Gepp & Gepp 1906: 261 (New South Wales). Additional records provided by Womersley & Johansen 1996b: 291.

STATUS IN 1996: spurious record based on misidentification; see Womersley & Johansen 1996b: 291.

C. clavigera Kützing 1858: 36.

SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Kützing 1858: 36; Sonder 1880: 21; De Toni 1905: 1854; Yendo 1905: 35. See Womersley & Johansen 1996b: 311.

STATUS IN 1996: Heterotypic synonym of *Halitilon roseum*; see Womersley & Johansen 1996b: 311.

C. constricta Kützing 1858: 40.

SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Kützing 1858: 40, pl. 84, figs c-h; De Toni 1905: 1852; Yendo 1905: 40. See Womersley & Johansen 1996b: 299.

STATUS IN 1996: Heterotypic synonym of *Jania micrathrodia*; see Womersley & Johansen 1996b: 299, 303.

NOTE: Yendo (1905: 40) treated the species as doubtful.

C. curvieri var. *crispata* (Lamouroux) Areschoug 1852: 572.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Sonder 1880: 21; Tisdall 1898: 508 (as *C. crispata*); Lucas & Perrin 1947: 399, figs 202c, 202d. Additional records provided by Womersley & Johansen 1996b: 310.

- STATUS IN 1996: Heterotypic synonym of *Haliptilon roseum*; see Womersley & Johansen 1996b: 310.
- C. denudata* (Sonder) Kützing 1858: 34.
 SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: De Toni 1905: 1854; Lucas & Perrin 1947: 399 (as *Corallina curvieri* var. *denudata*); Guiler 1952: 86. Additional records provided by Womersley & Johansen 1996b: 311.
 STATUS IN 1996: Heterotypic synonym of *Haliptilon roseum*; see Womersley & Johansen 1996b: 311.
- C. officinalis* Linnaeus 1758: 805.
 SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Womersley 1966: 146; King *et al.* 1971: 121. Additional records provided by Womersley & Johansen 1996b: 291.
 STATUS IN 1996: recognised as a distinct species of *Corallina*; see Appendix 2.
- C. pilulifera* Postels & Ruprecht 1840: 20.
 SOUTHERN AUSTRALIAN RECORD PRIOR TO 1976: Cribb 1954: 35. See Womersley & Johansen 1996b: 291.
 STATUS IN 1996: Spurious record based on misidentification; see Womersley & Johansen 1996b: 291.
- C. plumifera* Kützing 1849: 705.
 SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Kützing 1858: 36, pl. 71, fig. 2; Harvey 1863: xxx; De Toni 1905: 1854; Yendo 1905: 36. Additional records provided by Womersley & Johansen 1996b: 311.
 STATUS IN 1996: Heterotypic synonym of *Haliptilon roseum*; see Womersley & Johansen 1996b: 311.
 NOTE: Yendo (1905: 36) treated the species as doubtful.
- C. plumosa* Lamarck 1815: 235.
 SOUTHERN AUSTRALIAN RECORD PRIOR TO 1976: Lamarck 1815: 235. See Womersley & Johansen 1996b: 310.
 STATUS IN 1996: Heterotypic synonym of *Haliptilon roseum*; see Womersley & Johansen 1996b: 310.
- C. radiata* Lamarck 1815: 240 (non Yendo 1902: 26).
 SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lamarck 1815: 240; Areschoug 1852:541; Yendo 1905: 13. Additional records provided by Ducker 1979b: 85 and Womersley & Johansen 1996c: 319.
 STATUS IN 1996: Recognised as a distinct species of *Metagoniolithon*; see Appendix 2.
 NOTE: Yendo (1905: 13) treated the species as doubtful.
- C. rosea* var. *crispa* Lamarck 1815: 235.
 SOUTHERN AUSTRALIAN RECORD PRIOR TO 1976: Lamarck 1815: 235. See Womersley & Johansen 1996b: 310.
 STATUS IN 1996: Heterotypic synonym of *Haliptilon roseum*; see Womersley & Johansen 1996b: 310.
- C. trichocarpa* Kützing 1858: 35.
 SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: De Toni & Forti 1923: 62; Levring 1946: 221. Additional records provided by Womersley & Johansen 1996b: 311.
 STATUS IN 1996: Heterotypic synonym of *Haliptilon roseum*; see Womersley & Johansen 1996b: 311.

C. turneri Lamouroux 1816: 289.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lamouroux 1816: 289, pl. 10, fig. 2; Kützing 1849: 706; Yendo 1905: 36. Additional records provided by Womersley & Johansen 1996b: 311.

STATUS IN 1996: Heterotypic synonym of *Halpilton roseum*; see Womersley & Johansen 1996b: 311.

NOTE: Yendo (1905: 36) treated the species as doubtful.

Genus *Halpilton**H. subulatum* (Ellis & Solander) Johansen 1970: 79.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Tisdall 1898: 508 (as *Jania*); Lucas & Perrin 1947: 399 (as *Corallina cuvieri* var. *subulata*); King *et al.* 1971: 121. Additional records provided by Womersley & Johansen 1996b: 311.

STATUS IN 1996: Spurious record based on misidentification; see Womersley & Johansen 1996b: 311.

Genus *Jania**J. affinis* W.H. Harvey 1855: 547.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Sonder 1880: 21; De Toni 1905: 1857; Yendo 1905: 39; De Toni & Forti 1923: 63. Additional records provided by Johansen & Womersley 1994: 619; Womersley & Johansen 1996b: 309.

STATUS IN 1996: Heterotypic synonym of *Jania pulchella*; see Womersley & Johansen 1996b: 309.

J. compressa Lamouroux 1824: 624, pl. 90, figs 8-10.

SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lamouroux 1824: 624, pl. 90, figs 8-10; Yendo 1905: 40. See Womersley & Johansen 1996b: 311.

STATUS IN 1996: Heterotypic synonym of *Halpilton roseum*; see Womersley & Johansen 1996b: 311.

NOTE: Yendo (1905: 40) treated the species as doubtful.

J. fastigiata Harvey 1849: 107.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 397; Womersley 1966: 146; King *et al.* 1971: 121. Additional records provided by Womersley & Johansen 1996b: 299.

STATUS IN 1996: Heterotypic synonym of *Jania micrarthrodia*; see Womersley & Johansen 1996b: 299.

J. micrarthrodia Lamouroux 1816: 271.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 397; Chapman & Parkinson 1974: 175, pl. 58A. Additional records provided by Womersley & Johansen 1996b: 299.

STATUS IN 1996: Recognised as a distinct species of *Jania*; see Appendix 2.

TAXA BASED ON SOUTHERN AUSTRALIAN TYPES THAT WERE CONSIDERED SYNONYMS IN 1976: *J. antennina* Kützing 1843: 389 (see Chapman & Parkinson 1974: 176); *J. tenuissima* Sonder 1848: 186 (see Yendo 1905: 38; Chapman & Parkinson 1974: 175)

J. natalensis W.H. Harvey 1849: 107.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Womersley 1950: 167; Guiler 1952: 86; Chapman & Parkinson 1974: 176, pl. 58B. Additional records provided by Womersley & Johansen 1996b: 305.

STATUS IN 1996: Heterotypic synonym of *Jania verrucosa*; see Womersley & Johansen 1996b: 305.

J. pedunculata Lamouroux 1816: 270.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: De Toni 1905: 1856; Yendo 1905: 39; Chapman & Parkinson 1974: 177, text fig. 54. Additional records provided by Womersley & Johansen 1996b: 305.

STATUS IN 1996: Heterotypic synonym of *Jania verrucosa* Lamouroux; see Womersley & Johansen 1996b: 305.

NOTE: Yendo (1905: 39) treated the species as doubtful.

J. pusilla (Sonder) Yendo 1905: 39.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Tisdall 1898: 508 (as *Corallina*); Ducker *et al.* 1976: 1, figs 1, 3-7, 9-14. Additional records provided by Womersley & Johansen 1996b: 307.

STATUS IN 1996: Recognised as a distinct species of *Jania*; see Appendix 2.

TAXA BASED ON SOUTHERN AUSTRALIAN TYPES THAT WERE CONSIDERED SYNONYMS IN 1976: *Corallina nana* Lenormand *ex* W.H. Harvey 1863: xxx (non Zanardini 1844: 1024) (see Ducker *et al.* 1976: 1). *C. nana* Lenormand *ex* Harvey is an illegitimate older name for *Corallina pusilla* Sonder 1880: 21. *C. lenormandiana* Grunow *ex* De Toni 1905: 1851; Lucas & Perrin 1947: 400 (see Ducker *et al.* 1976: 3)

J. rubens (Linnaeus) Lamouroux 1816: 272.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas 1929: 53; Lucas & Perrin 1947: 398. Additional records provided by Womersley & Johansen 1996b: 299..

STATUS IN 1996: Spurious record based on misidentification; see Womersley & Johansen 1996b: 299.

Subfamily Lithophylloideae

¹Genus *Dermatolithon*

D. pustulatum (Lamouroux) Foslie 1898b: 11.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas 1929: 53; Levring 1946: 220 (as *Lithophyllum*); May 1965: 355. Additional records provided by Wilks & Woelkerling 1991: 529 and Woelkerling & Campbell 1992: 87.

STATUS IN 1996: Recognised as a distinct species of *Lithophyllum*; see Woelkerling & Campbell 1992: 78; Woelkerling 1996d: 227.

Genus *Lithophyllum*

L. amplexifrons (W.H. Harvey) Heydrich 1901: 536.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas 1929: 53; Lucas & Perrin 1947: 393. Additional records provided by Wilks & Woelkerling 1991: 527 and Woelkerling & Campbell 1992: 98.

STATUS IN 1996: Excluded from southern Australian flora; see Woelkerling & Campbell 1992: 98 and Chamberlain & Norris 1994: 15.

L. darwini (W.H. Harvey) Foslie 1900c: 18.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: De Toni 1905: 1780; Lucas 1912: 163. Additional records provided by Wilks & Woelkerling 1991: 527 and Woelkerling & Campbell 1992: 98.

STATUS IN 1996: Species of uncertain status; type missing (see Wilks & Woelkerling 1991; 527-528 and Woelkerling & Campbell 1992: 98).

L. hyperellum f. *fastigiata* Foslie 1900a: 27.

SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Foslie 1900a: 27; Foslie 1900c: 18; Lucas & Perrin 1947: 393 (as *Lithophyllum hyperellum*).

STATUS IN 1996: Homotypic synonym of *Spongites hyperellus* f. *hyperellus*; see Woelkerling & Campbell 1992: 100.

L. hyperellum f. *heteroidea* Foslie 1900a: 27.

SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Foslie 1900a: 27; Foslie 1900c: 18.

STATUS IN 1996: Heterotypic synonym of *Spongites hyperellus* f. *hyperellus*; see Penrose 1996c: 275.

L. okamurai f. *contigua* Foslie 1904b: 7.

SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Foslie 1904b: 7; De Toni 1924: 685; Masaki 1968: 37.

STATUS IN 1996: Species of uncertain status; type apparently missing (see Woelkerling & Campbell 1992: 98). According to Townsend *et al.* (1995: 93), however, *Lithophyllum okamurai* f. *contigua* may have been subsequently (Foslie 1907a: 12) redescribed as *Archaeolithothamnion australasicum*, and the two taxa are highly likely to be based on the same type. Masaki (1968: 35-37) provides further information on the species *Lithophyllum okamurai*.

L. tumidulum Foslie 1901c: 5.

SOUTHERN AUSTRALIAN RECORD PRIOR TO 1976: Foslie 1901c: 5.

STATUS IN 1996: Spurious record; see Woelkerling & Campbell 1992: 101.

Subfamily Mastophoroideae

Genus *Choreonema*

C. thuretii (Bornet in Thuret & Bornet) Schmitz 1889: 455.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: May 1965: 355. Chapman & Parkinson 1974: 170, fig. 53. Additional records provided by Woelkerling 1987a: 111.

STATUS IN 1996: Recognised as a distinct species of *Choreonema*; see Appendix 2.

²Genus *Fosliella*

F. farinosa (Lamouroux) Howe 1920: 587.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Levring 1946: 220 (as *Melobesia*); Lucas & Perrin 1947: 391 (as *Melobesia*); May 1965: 355; Chapman & Parkinson 1974: 186. Additional records provided by Wilks & Woelkerling 1991: 528.

STATUS IN 1996: Recognised as a distinct species of *Hydrolithon*; see Appendix 2.

³Genus *Heteroderma*

H. cymodoceae (Foslie) Adey 1970: 16.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 391 (as *Melobesia*); Adey & Lebednik 1967: 32 (as *Melobesia*). Additional records provided by Wilks & Woelkerling 1991: 527 and Penrose 1992a: 89-90.

STATUS IN 1996: Recognised as a distinct species of *Hydrolithon*; see Appendix 2.

H. leptura (Foslie) Foslie 1909: 56.

SOUTHERN AUSTRALIAN RECORD PRIOR TO 1976: Adey & Lebednik 1967: 35. See Wilks & Woelkerling 1991: 528.

STATUS IN 1996: Considered a heterotypic synonym of *Pneophyllum fragile* based on a comparison of relevant types during the present study; not mentioned in Penrose 1996b. Type collection also contains *Melobesia membranacea* but Foslie (1906:16. as *Melobesia*) makes no mention of multiporate conceptacles on protologue. Australian collection (Adey & Lebednik 1967: 35) belongs to *Pneophyllum fragile*.

Genus *Neogoniolithon*

N. finitima (Foslie) Setchell & Mason 1943: 91.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Foslie 1907a: 15 (as *Goniolithon setchellii* f. *finitima*); Foslie 1908: 5 (as *Goniolithon*); Printz 1929: pl. 47, figs 19-21 (as *Goniolithon*); Setchell & Mason 1943: 91; Adey & Lebednik 1967: 28 (as *Goniolithon*); Adey 1970: 8.

STATUS IN 1996: Heterotypic synonym of *Neogoniolithon brassica-florida*; see Penrose 1996d: 281.

N. verrucosum (Foslie) Adey 1970: 10.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 393 (as *Goniolithon*); Adey 1970: 10. Additional records provided by Penrose 1991: 200 and Woelkerling & Campbell 1992: 101.

STATUS IN 1996: Heterotypic synonym of *Spongites fruticulosus*; see Penrose 1996c: 277.

⁴Genus *Pseudolithophyllum*

P. hyperellum (Foslie) Adey 1970: 13.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 393 (as *Lithophyllum*); King 1973: 156, 157. Additional records and nomenclatural data provided by Woelkerling & Campbell 1992: 99-100.

STATUS IN 1996: Recognised as a distinct species of *Spongites*; see Penrose 1996c: 275.

P. tasmanicum (Foslie) Adey 1970: 14.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Guiler 1952: 86 (as *Melobesia*); Adey & Lebednik 1967: 17 (as *Lithophyllum*). Additional records provided by Woelkerling & Campbell 1992: 101.

STATUS IN 1996: Considered a heterotypic synonym of *Pneophyllum fragile* based on a comparison of relevant types during the present study; not mentioned in Penrose 1996b.

Subfamily Melobesioideae

⁵Genus *Archaeolithothamnion*

A. australasicum Foslie 1907a: 12.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Adey & Lebednik 1967: 84; Adey 1970: 18. Additional records provided by Townsend *et al.* 1995: 92.

STATUS IN 1996: Status uncertain; see comments of Townsend *et al.* 1995: 93. According to Townsend *et al.* (1995: 93), *Archaeolithothamnion australasicum* may first have been described as *Lithophyllum okamurai* f. *contigua*, and the two taxa are highly likely to be based on the same type.

A. durum Foslie 1907a: 11.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Adey & Lebednik 1967: 84 (as *Archaeolithothamnion*); Adey 1970: 18 (as *Archaeolithothamnion*). Additional records provided by Townsend *et al.* 1995: 86.

STATUS IN 1996: Recognised as a distinct species of *Sporolithon*; see Appendix 2.

A. erythraeum (Rothpletz) Foslie 1900c: 8.

SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Foslie 1907a: 12; Adey & Lebednik 1967: 85.

STATUS IN 1996: Spurious record; see Townsend *et al.* 1995: 93.

⁶Genus *Leptophyllum*

L. absonum (Foslie) Adey 1970: 29.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Printz 1929: 38, pl. 1, figs 11, 12 (as *Lithothamnion*); Adey & Lebednik 1967: 49 (as *Lithothamnion*); Adey 1970: 29. Additional records provided by Wilks & Woelkerling 1991: 191.

STATUS IN 1996: Heterotypic synonym of *Phymatolithon repandum*; see Wilks & Woelkerling 1994: 194; Woelkerling 1996b: 187.

L. repandum (Foslie) Adey 1970: 30.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Printz 1929: 451 pl. 1, fig. 10 (as *Lithothamnion*); Adey & Lebednik 1967: 83 (as *Lithothamnion*); Adey 1970: 30. Additional records provided by Wilks & Woelkerling 1994: 190.

STATUS IN 1996: Recognised as a distinct species of *Phymatolithon*; see Wilks & Woelkerling 1994: 190; Woelkerling 1996b: 187.

Genus *Lithothamnion*

L. antarcticum (W.H. Harvey & J.D. Hooker) Heydrich 1901: 544.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lemoine 1912: LIV; De Toni 1924: 621; Levring 1960: 36. Additional records provided by May & Woelkerling 1988: 69.

STATUS IN 1996: Heterotypic synonym of *Synarthrophyton patena*; see May & Woelkerling 1988: 68-69; Woelkerling 1996b: 207.

L. dissidens (Foslie) Foslie 1907b: 6.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: De Toni 1924: 627; Adey & Lebednik 1967: 49. Additional records provided by Wilks & Woelkerling 1995: 561.

STATUS IN 1996: Status uncertain; type from Cape Jaffa, South Australia apparently lacks conceptacles (see Wilks & Woelkerling 1994: 194).

L. engelhartii f. *imbricata* Foslie 1900a: 19.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Foslie 1900a: 19; De Toni 1905: 1749. Additional records provided by Woelkerling 1984: 66.

STATUS IN 1996: Homotypic synonym of *Mesophyllum engelhartii* f. *engelhartii*; see Woelkerling & Harvey 1993: 586; Woelkerling 1996b: 193.

L. engelhartii f. *pseudoerispata* Foslie 1901b: 27.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Foslie 1901b: 27; Reinbold 1903: 232; Printz 1929: pl. 7, fig. 18. Additional records provided by Woelkerling 1984: 90.

STATUS IN 1996: Taxon of uncertain status; holotype sterile (see Woelkerling & Harvey 1993: 586-587). The species *L. engelhartii* belongs to *Mesophyllum*; see Appendix 2.

L. engelhartii f. *umbonata* Foslie 1900a: 18.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: De Toni 1905: 1749; Printz 1929: 40, pl. 7, fig. 15; Chapman & Parkinson 1974: 200,

Pl 71, fig. B. Additional records provided by Woelkerling & Harvey 1993: 582.

STATUS IN 1996: Heterotypic synonym of *Mesophyllum engelhartii* f. *engelhartii*; see Woelkerling & Harvey 1993: 586; Woelkerling 1996b: 193

L. fruticosum (Kützinger) Foslie 1895: 46.

SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Foslie 1904a: 19, 24; Lemoine 1915: 11, 23.

STATUS IN 1996: Recognised as a distinct species of *Spongites*; see Appendix 2.

L. fruticosum f. *confinis* Foslie 1904b: 4.

SOUTHERN AUSTRALIAN RECORD PRIOR TO 1976: Foslie 1904b: 4.

STATUS IN 1996: Heterotypic synonym of *Lithothamnion indicum*; see Wilks & Woelkerling 1995: 558; Woelkerling 1996b: 179. The species *L. fruticosum* belongs to *Spongites*; see Appendix 2.

L. indicum Foslie 1907a: 7.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: De Toni 1924: 640; Adey & Lebednik 1967: 58-59. Additional records provided by Wilks & Woelkerling 1995: 558.

STATUS IN 1996: Recognised as a distinct species of *Lithothamnion*; see Appendix 2.

L. lenormandii f. *australis* Foslie 1901a: 8.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Foslie 1901a: 8; De Toni 1905: 1757; Lucas 1912: 162. Additional records provided by Woelkerling 1984: 32.

STATUS IN 1996: Heterotypic synonym of *Phymatolithon repandum*; see Wilks & Woelkerling 1994: 190, 194; Woelkerling 1996b: 187.

L. lichenoides (Ellis) Foslie 1895: 206.

See entry for *Mesophyllum lichenoides*.

L. mirabile (Foslie) Foslie 1909: 4.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 389 (as *Archaeolithothamnion*); Adey & Lebednik 1967: 52; Adey 1970: 20. Additional records provided by Townsend *et al.* 1995: 94 and Wilks & Woelkerling 1995: 554.

STATUS IN 1996: Heterotypic synonym of *L. muelleri*; see Wilks & Woelkerling 1995: 554, 557; Woelkerling 1996b: 181.

L. muelleri Lenormand *ex* Rosanoff 1866: 101.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 390; Adey & Lebednik 1967: 68; King *et al.* 1971: 121. Additional records provided by Wilks & Woelkerling 1995: 553-554.

STATUS IN 1996: Recognised as a distinct species of *Lithothamnion*; see Appendix 2.

L. muelleri f. *cingens* Foslie 1900b: 69.

SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Foslie 1900a: 17; Foslie 1900b: 69; De Toni 1905: 1751.

STATUS IN 1996: Homotypic synonym of *L. muelleri* f. *muelleri*; see Woelkerling 1993: 190; Woelkerling 1996b: 181.

Genus *Melobesia*

M. coronata Rosanoff 1866: 64.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 391; Adey & Lebednik 1967: 32. Additional records provided by Penrose 1990: 96 and Wilks & Woelkerling 1991: 527.

STATUS IN 1996: Recognised as a distinct species of *Pneophyllum*; see Appendix 2.

M. coronata f. *zonata* Foslie 1902: 9.

SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Foslie 1902: 9; Foslie 1904a: 56.

STATUS IN 1996: Considered a heterotypic synonym of *Pneophyllum coronatum* based on a comparison of relevant types during the present study; not mentioned in Penrose 1996b.

M. corticiformis Kützing 1849: 696.

SOUTHERN AUSTRALIAN RECORD PRIOR TO 1976: Barton 1893: 202. See Wilks & Woelkerling 1991: 524.

STATUS IN 1996: Heterotypic synonym of *M. membranacea*; see Chamberlain 1983: 300, 306; Wilks & Woelkerling 1991: 524.

M. membranacea (Esper) Lamouroux 1812: 186.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Harvey 1863: xxx; Lucas 1909: 55; Lucas 1912: 162 (as *Lithothamnion*). Additional records provided by Wilks & Woelkerling 1991: 522.

STATUS IN 1996: Recognised as a distinct species of *Melobesia*; see Appendix 2.

M. rosanoffii (Foslie) Lemoine 1912: LXIV.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Foslie 1908: 5 (as *Lithothamnion*); Adey & Lebednik 1967: 50. Additional records provided by Wilks & Woelkerling 1991: 525.

STATUS IN 1996: Recognised as a distinct species of *Melobesia*; see Appendix 2.

M. verrucata Lamouroux 1816: 316.

SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Harvey 1860: 311; Dickie 1876: 45. See Wilks & Woelkerling 1991: 529 and Woelkerling & Campbell 1992: 87.

STATUS IN 1996: Heterotypic synonym of *Lithophyllum pustulatum*; see Woelkerling & Campbell 1992: 79 and Woelkerling 1996d: 227.

Genus *Mesophyllum*

M. engelhartii (Foslie) Adey 1970: 581.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Printz 1929: 40, pl. 7, figs 12-14 (as *Lithothamnion engelhartii* f. *typica*); Adey & Lebednik 1967: 69 (as *Lithothamnion*). Additional records provided by Woelkerling & Harvey 1993: 581.

STATUS IN 1996: Recognised as a distinct species of *Mesophyllum*; see Appendix 2.

M. fumigatum (Foslie) Adey 1970: 24.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 390 (as *Lithothamnion*); Adey & Lebednik 1967 (as *Lithothamnion*). Additional records provided by Woelkerling & Harvey 1993: 582.

STATUS IN 1996: Heterotypic synonym of *Mesophyllum engelhartii*; see Woelkerling & Harvey 1993: 582, 586; Woelkerling 1996b: 193.

M. gabrieli (Foslie) Adey 1970: 24.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: De Toni 1924: 628 (as *Lithothamnion*); Adey & Lebednik 1967: 64 (as *Lithothamnion*);

- Adey 1970: 24. Additional records provided by Wilks & Woelkerling 1995: 554.
- STATUS IN 1996: Heterotypic synonym of *Lithothamnion muelleri*; see Wilks & Woelkerling 1995: 554, 557; Woelkerling 1996b: 181.
- M. incisum* (Foslie) Adey 1970: 24.
- SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Cribb 1954: 35 (as *Lithothamnion*); Guiler 1960: 21 (as *Lithothamnion*); Adey & Lebednik 1967: 68 (as *Lithothamnion*). Additional records provided by Woelkerling & Harvey 1993: 587.
- STATUS IN 1996: Recognised as a distinct species of *Mesophyllum*; see Appendix 2.
- NOTE: Chapman & Parkinson (1974: 202) treated this taxon as a New Zealand endemic under the name *Polyporolithon patena* var. *incisa* (Foslie) Chapman & Parkinson; Johnson (1977: 117) subsequently used the binomial *Mesophyllum incisum* for New Zealand material.
- M. lemniscatum* (Foslie) Adey 1970: 25.
- SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Foslie 1907b: 11 (as *Lithothamnion*); Printz 1929: 43, pl. 7, fig. 11 (as *Lithothamnion*); Adey & Lebednik 1967: 66 (as *Lithothamnion*). Additional records provided by Woelkerling & Harvey 1993: 582.
- STATUS IN 1996: Heterotypic synonym of *M. engelhartii*; see Woelkerling & Harvey 1993: 582, 586; Woelkerling 1996b: 193.
- M. lichenoides* (Ellis) Lemoine 1928: 251.
- SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 390; Guiler 1954: 108, 110, 116. Additional records provided by Woelkerling & Harvey 1993: 598.
- STATUS IN 1996: Spurious or unconfirmed record; see Woelkerling & Harvey 1993: 598.
- M. neglectum* (Foslie) Adey 1970: 25.
- SOUTHERN AUSTRALIAN RECORD PRIOR TO 1976: Foslie 1900a: 18 (as *Lithothamnion muelleri* f. *neglecta*).
- STATUS IN 1996: Spurious record (see Woelkerling 1993: 137 and Woelkerling & Harvey 1993: 586, 598); the southern Australian specimen cited by Foslie (1900a: 18) was subsequently (Foslie 1907b: 11) redescribed as *Lithothamnion lemniscatum* Foslie; the latter is a heterotypic synonym of *Mesophyllum engelhartii* (see entry above for *Mesophyllum lemniscatum*).
- M. rupestre* (Foslie) Adey 1970: 26.
- SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Printz 1929: 37, pl. 54, fig. 1 (as *Lithophyllum*); Adey & Lebednik 1967: 18 (as *Lithophyllum*). Additional records provided by Woelkerling & Campbell 1992: 100 and Woelkerling & Harvey 1993: 599.
- STATUS IN 1996: Recognised as a distinct species of *Hydrolithon*; see Appendix 2.
- M. squamuliforme* (Foslie) Adey 1970: 26.
- SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Printz 1929: 46, pl. 3, fig. 13 (as *Lithothamnion*); Adey & Lebednik 1967: 53 (as *Lithothamnion*). Additional records provided by Woelkerling & Harvey 1993: 600.

STATUS IN 1996: Species of uncertain status; type poorly preserved but possibly conspecific with *M. engelhartii* (see Woelkerling & Harvey 1993: 600).

M. versicolor (Foslie) Adey 1970: 26.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Printz 1929: 47, pl. 12, figs 1, 2; Adey & Lebednik 1967: 82. Additional records provided by Woelkerling 1984: 112 and Woelkerling & Harvey 1993: 582.

STATUS IN 1996: Heterotypic synonym of *M. engelhartii*; see Woelkerling & Harvey 1993: 582, 586; Woelkerling 1996b: 193.

Subfamily Metagoniolithoideae

Genus *Metagoniolithon*

M. charoides (Lamouroux) Weber van Bosse 1904: 102.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 394 (as *Amphiroa*); May 1965: 356; Ganesan 1971: 248; King *et al.* 1971: 121. Additional records provided by Ducker 1979b: 85 and Womersley & Johansen 1996c: 319.

STATUS IN 1996: Heterotypic synonym of *M. radiatum*; see Womersley & Johansen 1996c: 319.

TAXA BASED ON SOUTHERN AUSTRALIAN TYPES THAT WERE CONSIDERED SYNONYMS IN 1976: *Amphiroa stellata* Kützing 1849: 702 (see Weber van Bosse 1904: 103 & Yendo 1905: 12); *Corallina gallioides* Lamarck 1815: 239 (see Yendo 1905: 12; Womersley & Johansen 1996c: 321 follow Ducker 1979b: 88 in listing this entity as a heterotypic synonym of *M. chara*).

M. gracile (W.H. Harvey) Yendo 1905: 12.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: May 1965: 356; Ganesan 1971: 248. Additional records provided by Ducker 1979b: 96 and Womersley & Johansen 1996a: 286.

STATUS IN 1996: recognised as a distinct species of *Amphiroa*; see Appendix 2.

M. graniferum (W.H. Harvey) Weber-van Bosse 1904: 103.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Segawa 1949: 52; May 1965: 356. Additional records provided by Ducker 1979b: 89 and Womersley & Johansen 1996c: 321.

STATUS IN 1996: Heterotypic synonym of *M. chara*; see Womersley & Johansen 1996c: 321.

TAXA BASED ON SOUTHERN AUSTRALIAN TYPES THAT WERE CONSIDERED SYNONYMS IN 1976: *Amphiroa intermedia* W.H. Harvey 1855: 547; *A. similis* Sonder 1880: 20 (see Weber van Bosse 1904: 103; additional references given by Ducker 1979b: 89).

M. stelliferum (Lamarck) Weber van Bosse 1904: 103.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 394 (as *Amphiroa stelligera*); May 1965: 320 (as *stelligerum*); Ganesan 1971: 248; figs 1-12 (as *stelligerum*); King *et al.* 1971: 121 (as *stelligerum*). Additional records provided by Ducker 1979b: 83 and Womersley & Johansen 1996c: 320.

STATUS IN 1996: recognised as a distinct species of *Metagoniolithon*; see Appendix 2.

TAXA BASED ON SOUTHERN AUSTRALIAN TYPES THAT WERE CONSIDERED SYNONYMS IN 1976: *Corallina interrupta* Lamarck 1815: 239; *Amphiroa jubata* Lamouroux 1816: 301, pl. 11, fig. 6; *A. verrucosa* Lamouroux 1816:

300, pl. 11, fig. 4; *A. elegans* Sonder 1845: 55 (see Weber van Bosse 1904: 103 & Yendo 1905: 12; additional references given in Ducker 1979b: 83-84).

NOTE: The orthographic variant *stelligerum* (*stelligera*), first coined by Decaisne (1842b: 124), has been widely used.

Taxa of uncertain status or not mentioned by Johansen (1976)

⁷Genus *Chaetolithon*

C. deformans (Solms-Laubach) Foslie 1898b: 7.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lemoine 1912: LIII; Kylin: 1956: 206. Additional records provided by Woelkerling 1987a and Wilks & Woelkerling 1991: 528.

STATUS IN 1996: Heterotypic synonym of *Choreonema thuretii*; see Woelkerling 1987a: 280; Woelkerling 1996c: 212, 214.

⁸Genus *Cornicularia* (A. V. Manza) V.J. Chapman & P.G. Parkinson 1974: 182.

C. cuvieri (Lamouroux) Chapman & Parkinson 1974: 184.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 399, figs 202a, 202b (as *Corallina*); Womersley 1966: 146 (as *Corallina*); Chapman & Parkinson 1974: 184, text fig. 56, pl. 59, fig. B. Additional records provided by Womersley & Johansen 1996b: 310.

STATUS IN 1996: Heterotypic synonym of *Halitilton roseum*; see Womersley & Johansen 1996b: 310.

C. gracilis (Lamouroux) Chapman & Parkinson 1974: 183.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 394 (as *Amphiroa*); Cribb 1954: 36, 37 (as *Corallina*); Chapman & Parkinson 1974: 183. Additional records provided by Womersley & Johansen 1996b: 311.

STATUS IN 1996: Heterotypic synonym of *Halitilton roseum*; see Womersley & Johansen 1996b: 311.

C. granifera (Ellis & Solander) Chapman & Parkinson 1974: 186.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Sonder 1880: 21 (as *Corallina*); De Toni & Forti 1923: 62 (as *Corallina*); Lucas & Perrin 1947: 374 (as *Amphiroa*). Additional records provided by Womersley & Johansen 1996b: 311.

STATUS IN 1996: Spurious record based on misidentification; see Womersley & Johansen 1996b: 311.

C. pilifera (Lamouroux) Chapman & Parkinson 1974: 185.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 400 (as *Corallina*); Guiler 1952: 86 (as *Corallina*); Chapman & Parkinson 1974: 185. Additional records provided by Womersley & Johansen 1996b: 311.

STATUS IN 1996: Heterotypic synonym of *Halitilton roseum*; see Womersley & Johansen 1996b: 311.

C. rosea (Lamarck) Chapman & Parkinson 1974: 310.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Chapman & Parkinson 1974: 310. Additional records provided by Womersley & Johansen 1996b: 310.

STATUS IN 1996: Recognised as a distinct species of *Halitilton*; see Appendix 2.

⁹Genus *Goniolithon* Foslie 1898a: 5 (not *Goniolithon* Foslie 1900c: 15)

G. elatocarpum f. *australasicum* Foslie 1901a: 19.

SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Foslie 1901a: 19; Foslie 1909: 9; Lucas & Perrin 1947: 393 (as *Goniolithon elatocarpum*).

STATUS IN 1996: Species of uncertain status within *Lithothamnion*; type in poor condition (see Woelkerling 1996b: 183).

¹⁰Genus *Lichenella*

L. brentii J.E. Gray 1858: 322.

SOUTHERN AUSTRALIAN RECORD PRIOR TO 1976: Hastings 1960: 245. See Woelkerling 1980b: 233.

STATUS IN 1996: Heterotypic synonym of *Metamastophora flabellata*; see Woelkerling 1980b: 233-235; Woelkerling 1996f: 243.

¹¹Genus *Metamastophora*

M. canaliculata (W.H. Harvey) Setchell 1943: 132.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 391 (as *Mastophora*); Guiler 1952: 87 (as *Mastophora*); May 1965: 357. Additional records provided by Woelkerling 1996b: 175.

STATUS IN 1996: Recognised as a distinct species of *Mastophoropsis*; see Appendix 2.

M. flabellata (Sonder) Setchell 1943: 131.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: May 1965: 357; Shepherd & Womersley 1970: 133. Additional records provided by Woelkerling 1980b: 232.

STATUS IN 1996: Recognised as a distinct species of *Metamastophora*; see Appendix 2.

M. lamourouxii (Decaisne ex W.H. Harvey) Setchell 1943: 131.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 391 (as *Mastophora*); May 1965: 357. Additional records provided by Woelkerling 1980b: 232.

STATUS IN 1996: Heterotypic synonym of *M. flabellata*; see Woelkerling 1980b: 232, 1996f: 243.

M. plana (Sonder) Setchell 1943: 133.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lemoine 1912: lxx (as *Mastophora*); May 1965: 357. Additional records provided by Woelkerling 1980b: 232.

STATUS IN 1996: Heterotypic synonym of *M. flabellata*; see Woelkerling 1980b: 232, 1996f: 243.

¹²Genus *Polyporolithon*

P. patena (Hooker & W.H. Harvey in W.H. Harvey) Mason 1953: 317.

SELECTED SOUTHERN AUSTRALIAN RECORDS PRIOR TO 1976: Lucas & Perrin 1947: 390 (as *Lithothamnion lichenoides* var. *patena*); May 1965: 355; Chapman & Parkinson 1974: 201, pl. 72. Additional records provided by Townsend 1979: 252, May & Woelkerling 1988: 69 and Woelkerling & Harvey 1993: 599.

STATUS IN 1996: Recognised as a distinct species on *Synarthrophyton*; see Appendix 2.

Notes ■ Appendix 1

¹ Johansen (1976: 232) followed Adey (1970: 6) in adopting the name *Tenarea* instead of *Dermatolithon*, but neither of them effected a combination in *Tenarea* for the species recorded from southern

